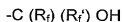


In another embodiment, the resist comprises a fluorine-containing copolymer comprising:

- (i) a repeat unit derived from at least one ethylenically unsaturated compound containing at least three fluorine atoms covalently attached to two ethylenically unsaturated carbon atoms; and
- 5 (ii) a repeat unit derived from an ethylenically unsaturated compound comprised of a fluoroalcohol functional group having the structure:



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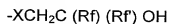
wherein R_f and R_f' are the same or different fluoroalkyl groups of from 1 to about 10 carbon atoms or taken together are $(CF_2)_n$ wherein n is 2 to 10. The fluorine-containing copolymer contains sufficient functionality to render the photoresist developable so as to produce a relief image upon imagewise exposure to ultraviolet radiation having wavelength of <365 nm.

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In yet another embodiment, a photoresist comprises:

- (a) a fluorine-containing copolymer comprising a repeat unit derived from at least one ethylenically unsaturated compound containing a fluoroalcohol functional group having the structure:

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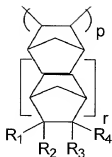
wherein R_f and R_f' are the same or different fluoroalkyl groups of from 1 to about 10 carbon atoms or taken together are $(CF_2)_n$ wherein n is 2 to 10; and X is selected from the group consisting of sulfur, oxygen, nitrogen, phosphorous, other Group Va element, and other Group VIa element.

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- (b) at least one photoactive component; wherein the fluorine-containing copolymer contains sufficient functionality to render the photoresist developable so as to produce a relief image upon imagewise exposure to ultraviolet radiation having wavelength of < 365 nm.

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In certain embodiments, a photoresist comprises a fluorine-containing polymer comprising the structure:

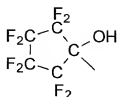


- 5 wherein each of R_1 , R_2 , R_3 , and R_4 independently is hydrogen, a halogen atom, a hydrocarbon group containing from 1 to 10 carbon atoms, a substituted hydrocarbon group, an alkoxy group, a carboxylic acid, a carboxylic acid ester, or a functional group containing the structure: $-C(R_f)(R'_f)OR_b$ wherein R_f and R'_f are the same or different fluoroalkyl groups of from 1 to 10 carbon atoms or taken together are $(CF_2)_n$ wherein n is 2 to 10; R_b is hydrogen or an acid- or base-labile protecting group; p is the number of repeat units in the polymer; r is 0-4; at least one of the repeat units has a structure whereby at least one of R_1 , R_2 , R_3 , and R_4 contains the structure $C(R_f)(R'_f)OR_b$; and wherein the fluorine-containing polymer has an
- 10 absorption coefficient of less than 4.0 absorption unit per micron at a wavelength of 157 nm.
- 15

Fluorinated Alcohol (Co) polymers

- A given fluorine-containing polymer or copolymer described above comprises a repeat unit (discussed *infra*) derived from at least one
- 20 ethylenically unsaturated compound containing a fluoroalcohol functional group. These fluoroalkyl groups are designated as R_f and R'_f , which can be partially fluorinated alkyl groups or fully fluorinated alkyl groups (i. e., perfluoroalkyl groups). Broadly, R_f and R'_f are the same or different fluoroalkyl groups of from 1 to about 10 carbon atoms or taken together are $(CF_2)_n$
- 25 wherein n is 2 to 10. (In the last sentence, the terms "taken together" indicate that R_f and R'_f are not separate, discrete fluorinated alkyl groups, but that

together they form a ring structure such as is illustrated below in case of a 5-membered ring:



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R_f and R_{f'} can be partially fluorinated alkyl groups without limit according to the invention except that there should be a sufficient degree of fluorination present to impart acidity to the hydroxyl (-OH) of the fluoroalcohol functional group, such that the hydroxyl proton is substantially removed in basic media, such as in aqueous sodium hydroxide solution or tetraalkylammonium hydroxide solution.

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In preferred cases according to the invention, there will be sufficient fluorine substitution present in the fluorinated alkyl groups of the fluoroalcohol functional group such that the hydroxyl group will have a pK_a value as follows:

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5 < pK_a < 11. Preferably, R_f and R_{f'} are independently perfluoroalkyl group of 1 to 5 carbon atoms, and, most preferably, R_f and R_{f'} are both trifluoromethyl (CF₃).

As is well known to those skilled in the polymer art, an ethylenically unsaturated compound undergoes free radical polymerization to afford a polymer having a repeat unit that is derived from the ethylenically unsaturated compound.

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Specifically, an ethylenically unsaturated compound having structure:



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